

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR,  
PNP, GERMANIUM, HIGH-POWER  
TYPE 2N665

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the detailed requirements for a high-power, germanium, PNP, Transistor.

1.2 Physical dimensions. See figure 1 (TO-3).

1.3 Maximum ratings.

$P_T \frac{1}{T_C = 25^\circ \text{C}}$	$V_{CBO}$	$V_{EBO}$	$V_{CEO}$	$I_E$	$I_B$	$T_{stg}$
<u>W</u>	<u>Vdc</u>	<u>Vdc</u>	<u>Vdc</u>	<u>Adc</u>	<u>Adc</u>	<u>° C</u>
35	-80	-40	-40	5	1	-65 to +100

1/ Derate linearly 0.466 W/°C for  $T_C > 25^\circ \text{C}$ .

1.4 Primary electrical characteristics.

	$h_{FE}$	$h_{FE}$	$f_{hfe}$	$V_{CE(sat)}$	$V_{BE}$
	$V_{CE} = -2 \text{ Vdc}$ $I_C = -0.5 \text{ Adc}$	$V_{CE} = -2 \text{ Vdc}$ $I_C = -2 \text{ Adc}$	$V_{CE} = -14 \text{ Vdc}$ $I_C = -2 \text{ Adc}$	$I_B = -220 \text{ mAdc}$ $I_C = -3 \text{ Adc}$	$V_{CE} = -2 \text{ Vdc}$ $I_C = -2 \text{ Adc}$
			<u>kc</u>	<u>Vdc</u>	<u>Vdc</u>
Min	40	20	20	---	---
Max	80	--	--	-0.9	-1.5

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATION

MILITARY

MIL-S-19500 - Semiconductor Devices, General Specification for

## STANDARDS

### MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.  
MIL-STD-750 - Test Methods for Semiconductor Devices.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

### 3. REQUIREMENTS

3.1 General. Requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-S-19500 and as follows:

V<sub>CEO</sub> - - - - - Collector to emitter voltage (static), base open.

3.3 Design and construction. Transistors shall be of the design, construction, and physical dimensions shown on figure 1.

3.4 Performance characteristics. Performance characteristics shall be as specified in tables I, II, and III.

3.5 Marking. The following marking specified in MIL-S-19500 may be omitted from the body of the transistor at the option of the manufacturer:

- (a) Country of origin.
- (b) Manufacturer's identification.

### 4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I, II, and III.

4.3 Quality conformance inspection. Quality conformance inspection shall consist of groups A, B, and C inspections.

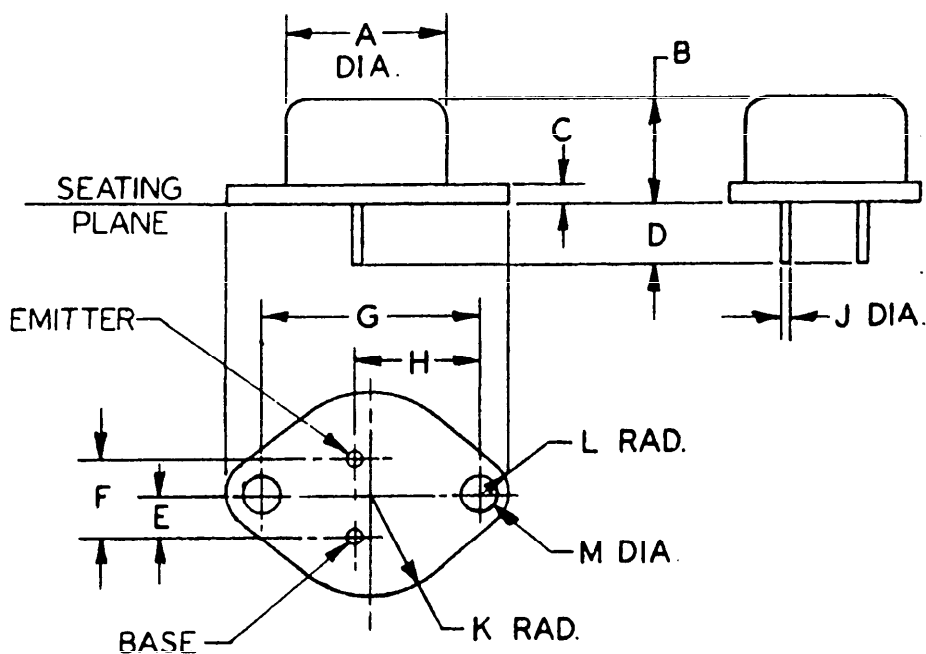
4.3.1 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table I.

4.3.2 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table II.

4.3.3 Group C inspection. Group C inspection shall consist of the examinations and tests specified in table III. This inspection shall be conducted on the initial lot and thereafter every 6 months during production.

4.4 Methods of examination and test. Methods of examination and test shall be as specified in tables I, II, and III.

4.5 Inspection lot. Inspection lot shall be as defined in MIL-S-19500 except that lot accumulation period requirements shall be six months in lieu of six weeks.



NOTES:

1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. This dimension should be measured at points .050 (1.27 mm) to .055 (1.40 mm) below seating plane. When gage is not used, measurement will be made at seating plane.
3. Two leads.
4. Collector shall be electrically connected to the case.

DIMENSIONS					NOTES
LTR	INCHES		MILLIMETERS		
	MIN	MAX	MIN	MAX	
A	---	.875	---	22.23	
B	.250	.450	6.35	11.43	
C	---	.135	---	3.43	
D	.312	---	7.92	---	3
E	.205	.225	5.21	5.72	
F	.420	.440	10.67	11.18	
G	1.177	1.197	29.90	30.40	
H	.655	.675	16.64	17.15	2
J	.038	.043	.97	1.09	3
K	---	.525	---	13.34	
L	---	.188	---	4.78	
M	.151	.161	3.84	4.09	

FIGURE 1. Physical dimensions of transistor type 2N665 (TO-3).

TABLE I. Group A inspection

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 1</u>			10				
Visual and mechanical examination	2071			---	---	---	---
<u>Subgroup 2</u>			5				
Emitter to base cutoff current	3061	Bias cond. D; $V_{EB} = -40$ Vdc		$I_{EBO}$	---	-2	mAdc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -2$ Vdc		$I_{CBO}$	---	-50	$\mu$ Adc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -60$ Vdc		$I_{CBO}$	---	-2	mAdc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -80$ Vdc		$I_{CBO}$	---	-10	mAdc
Forward-current transfer ratio	3076	$V_{CE} = -2$ Vdc; $I_C = -0.5$ Adc		$h_{FE}$	40	80	---
Forward-current transfer ratio	3076	$V_{CE} = -2$ Vdc; $I_C = -2$ Adc		$h_{FE}$	20	---	---
Base emitter voltage (nonsaturated)	3066	Test cond. A; $V_{CE} = -2$ Vdc; $I_C = -2$ Adc		$V_{BE}$	---	-1.5	Vdc
Collector to emitter voltage (saturated)	3071	$I_C = -3$ Adc; $I_B = -220$ mAdc		$V_{CE(sat)}$	---	-0.9	Vdc
Floating potential	3020	$V_{CB} = -80$ Vdc; voltmeter input resistance = 10 megohms min		$V_{EBF}$	---	-1	Vdc
Breakdown voltage, collector to emitter	3011	Bias cond. D; $I_C = -300$ mAdc		$BV_{CEO}$	-40	---	Vdc
<u>Subgroup 3</u>			5				
Small-signal short-circuit forward-current transfer-ratio cutoff frequency	3301	$V_{CE} = -14$ Vdc $I_C = -2$ Adc		$f_{hfe}$	20	---	kc
High-temperature operation: Emitter to base cutoff current	3061	$T_C = 71^\circ$ C; Bias cond. D; $V_{EB} = -30$ Vdc		$I_{EBO}$	---	-2	mAdc
Collector to base cutoff current	3036	$T_C = 71^\circ$ C; Bias cond. D; $V_{CB} = -30$ Vdc		$I_{CBO}$	---	-2	mAdc
Low-temperature operation: Forward-current transfer	3076	$T_C = -55^\circ$ C; $V_{CE} = -2$ Vdc; $I_C = -0.5$ Adc		$h_{FE}$	30	---	---

TABLE II. Group B inspection

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 1</u>			20				
Physical dimensions	2066	(See figure 1)		---	---	---	---
<u>Subgroup 2</u>			15				
Solderability	2026	Dwell time = 10 ± 1 sec; omit aging		---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. B except high temp. = + 100 <sup>+3°</sup> <sub>-0</sub> C		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. B		---	---	---	---
Terminal strength (tension)	2036	Test cond. A; weight = 10 lbs; time = 15 ± 3 sec each lead		---	---	---	---
Terminal strength (lead torque)	2036	Test cond. D <sub>1</sub> ; torque = 6 in-oz; time = 15 ± 3 sec each lead		---	---	---	---
Seal (leak-rate)	---	Method 112 of MIL-STD- 202, test cond. C, procedure III; test cond. B for gross leaks		---	---	5x10 <sup>-7</sup>	atm cc/sec
Moisture resistance	1021	Omit initial conditioning		---	---	---	---
End points: Collector to base cutoff current	3036	Bias cond. D; V <sub>CB</sub> = -60 Vdc		I <sub>CBO</sub>	---	-2	mAdc
Forward-current transfer ratio	3076	V <sub>CE</sub> = -2 Vdc; I <sub>C</sub> = -0.5 Adc		h <sub>FE</sub>	40	80	---
<u>Subgroup 3</u>			15				
Shock	2016	Nonoperating; 500 G; for 1 msec; 5 blows in each orientation: X <sub>1</sub> , Y <sub>1</sub> , Y <sub>2</sub> , and Z <sub>1</sub>		---	---	---	---
Vibration fatigue	2046	Nonoperating; 10 G		---	---	---	---
Vibration, variable frequency	2056	Nonoperating; 10 G		---	---	---	---
Constant acceleration	2006	10,000 G; in each orienta- tion: X <sub>1</sub> , Y <sub>1</sub> , Y <sub>2</sub> , and Z <sub>1</sub>		---	---	---	---
End points: (Same as for subgroup 2)							

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 4</u>			15				
Salt atmosphere (corrosion)	1041			---	---	---	---
End point: (same as for sub- group 2)							
<u>Subgroup 5</u>			$\lambda = 15$				
High-temperature life (nonoperating)	1031	$T_{stg} = +100^{\circ} \text{ C}$		---	---	---	---
End points: Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -60 \text{ Vdc}$		$I_{CBO}$	---	-4	mAdc
Forward-current transfer ratio	3076	$V_{CE} = -2 \text{ Vdc}$ $I_C = -0.5 \text{ Adc}$		$h_{FE}$	32	96	---
<u>Subgroup 6</u>			$\lambda = 10$				
Steady state operation life	1026	$T_C = +75^{\circ} \text{ C};$ $P_T = 10 \text{ W}$		---	---	---	---
End points: (Same as for subgroup 5)							

TABLE III. Group C inspection

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 1</u>			15				
Barometric pressure, reduced (altitude operation)	1001	Normal mounting; pressure = 8 mm Hg for 60 sec. min.		---	---	---	---
Measurement during test:							
Collector to base cutoff current	3036	Bias cond. D; V <sub>CB</sub> = -80 Vdc		I <sub>CBO</sub>	---	-10	mAdc
Thermal resistance	3151			θ <sub>J-C</sub>	---	2	°C/W

## 5. PREPARATION FOR DELIVERY

5.1 See MIL-S-19500, section 5.

## 6. NOTES

6.1 Notes. The notes specified in MIL-S-19500 are applicable to this specification.

6.2 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

### Custodians:

Army - EL

Navy - SH

Air Force - 11

### Preparing activity:

Army - EL

(Project 5961-0002-22)

### Review activities:

Army - EL, MU, MI,

Navy - SH

Air Force - 11, 17, 85

### User activities:

Army - EL, SM

Navy - CG, MC, WP

Air Force - 14, 19